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The Mechanism of Pneumonia; and its Treatment.

BY
W. C. VAN BIBBER, M.D.,
OF BALTIMORE, MD.

Read in the Section of Practice of Medicine, at the Thirty-ninth Annual Meeting of the American Medical Association, May 8, 1888.

Reprinted from the "Journal of the American Medical Association," July 28, 1888.



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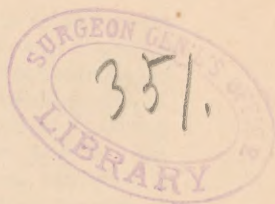


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THE MECHANISM OF PNEUMONIA; AND ITS TREATMENT.

The two objects of this paper are, *first*, an inquiry into the initial causes of pneumonia; and *secondly*, the treatment of the disease.

In order to demonstrate what may be termed the "Mechanism of Pneumonia" in a manner deemed necessary for the purpose of this paper, a few words concerning the anatomical arrangement of the parts must be said.

First, as to the definition of pneumonia itself. Since the crepitant râle was discovered, and its significance explained, it has been believed by auscultators that pathological changes may occur on one side only of the dividing membrane or partition of the lungs, whilst at the same time, upon the other side of this membrane, there may, at the beginning of the trouble, be but little or no disease. It is further believed, that by means of this râle, the diseases on the one side of this partition in the lungs can be distinguished from those upon the other side.

The wonder of this achievement is all the greater, because this dividing or partition wall is neither thick nor straight, but ramifies in the most zigzag manner throughout the planes of the lungs in all directions. It is somewhat a stretch of the imagination to call it a wall or partition, as it is a microscopic picture, yet none the less effective to fulfil its intention. For the practical purpose in view it may be thus described:

When one takes a deep inhalation, the air goes towards the minute bronchi, and empties into the

stationary air space which fills the alveoli and infundibula of the lungs. We know that the heart is beating, and that the minute branches from the pulmonary artery are winding around and around the partitions of these alveoli and infundibula in an interweaving and spiral manner; so that, upon this side (the air side), we have the air, and, to use a Saxon word, on "yonder" side we have the blood in its vessels—and we cannot strictly say on yonder side either—because the intertwining, plaited arrangement of the vessels puts the blood on both sides.

It is this dividing wall, such as it is, which stands as a basis of the classification of the diseases of the lungs into two distinct varieties. These are diagnosed by different sounds and symptoms; and, notwithstanding the minuteness of the wall, they are, at present, treated upon entirely different principles, and with different remedies. It must be remembered, also, that the air from the outside, in all its variations of quality and temperature, is in communication with the blood on the inside only as it is contained in its vessels; and these vessels are arranged on the air cells, in a system of capillaries which, although not the most minute, are more numerous than in any other part of the body. It is the changes in these capillaries that are to be considered. When they are congested or inflamed; this is pneumonia.

There are twenty-five diseases of the lungs and air-passages now described. Seventeen of these are described as occurring upon the air-side or external to this partition wall; six as occurring across its border, or upon the inside of it; and in the remaining two, as the double nomenclature indicates, the wall membrane itself is involved in the disease with its adjacent lung substance on both sides. The lungs are therefore exposed to

causes of disease from without as well as from within, and for this reason, it may be, their diseases, far above all others, are the most destructive to human life. The statistics of one of them alone (consumption) claims for it the first place upon the mortuary list, and for another, pneumonia, there is claimed the second place in the mortuary list, in some situations.

Nothing more need be said concerning the importance of the study of the disease now under consideration than that, for every man in this room over 65 years old, according to the statistics, if he dies of any acute disease, there are nine chances in ten that he will die of pneumonia. Hence the further study of this disease claims attention. It is generally admitted that there must be something wrong, in this country at least, about its treatment, its statistics or its study, because, it is said, there are now a greater proportionate number of cases, and a larger mortality, than there were forty years ago,¹ and this is not the case in England. Should this indeed be the fact in our country, if now, in this paper, a deviation from the beaten road along which the disease has been observed so long should be attempted, so that it may be viewed from a different standpoint and approached in a new way, let us hope that some good may result; particularly if that way should fortunately prove trustworthy and direct.

The term "mechanism of pneumonia" has not hitherto been used by those who have described and explained the nature of this disease. The term has been used for other diseases of the lungs, as the mechanism of empysema,² etc. It is a good term, and may be used to convey something more

¹ Henry H. Hartshorne, M.D. *Pneumonia, Its Mortality and Treatment*, p. 5.

² Rindfleisch. *Path. Histology*, vol. ii, p. 5.



than what is known as the etiology of the disease, and likewise something different from its morbid anatomy and pathological histology; indeed, it may stand intermediate between these two, in an attempt to connect them as cause and effect. By means of the term "mechanism of pneumonia" an attempt will be made to show, in a general way, how those different changes in the structure of the lungs are brought about which are recognized during life; which are demonstrated by the scalpel; are seen after death by the microscope; and are so minutely described by classical authors in their different departments. In order to do this, it is necessary to seek for the cause, or causes, which throw the blood from its natural healthy channels, and produce these effects, or changes. It is admitted that congestion of the capillaries is the first step in the process of pneumonia. It only remains, therefore, to show in what way this congestion may be produced. It will be admitted that if the *modus operandi* of the predisposing causes are made clear, viz., as to how they assist, and favor the production of pneumonia when they are brought into action by the exciting cause—then a study of this process may give many valuable suggestions in the management of this disease.

It may now be asked, What are really the exciting, and predisposing, causes of pneumonia? A better way of putting the question, however, at this time and under all the circumstances, may be, What are *not* the predisposing causes of pneumonia? In general terms it may be said, in the language of a modern author, "that all conditions which tend to impair the general health favor the occurrence of pneumonia."³ If this be accepted as a medical aphorism, then the etiology of pneumonia would comprise a long list, and one too

³ T. Henry Green. Path. and Morbid Anatomy, p. 364.

endless to be used at present. Yet some selection of these causes must be made, and in doing so, those *only* that are admitted to be the most frequent will be considered.

Amongst the recognized predisposing causes of pneumonia there are four, which are quite different from each other, and each one of them must produce the same effect, viz.: congestion in the capillaries, by a different mode of action. These are age, cold, malaria and alcohol.

What could be more different from one another than the four causes which have been enumerated? Two of them, at least, deteriorate the general health, each in its own way; but by what particular manner or mechanism, why, or how, any one, or all of them combined, become direct or predisposing causes of pneumonia, may be of interest to inquire, and to understand if we can.

As regards age, so much would have to be said for all periods of life, that it is impossible to treat of it now. It will be alluded to again in the treatment of the disease.

It is curiously doubted now by some of the most eminent physicians and pathologists, whether cold is as frequent a cause of pneumonia as it was at one time considered to be; or, indeed, whether it has any agency in causing the disease at all. This is, indeed, the great absorbing idea of the day, so far as this disease is concerned, and about which more must be said hereafter.

Fully appreciating the importance of pneumonia, on account of its increasing prevalence, its destructive crippling of health, and its large mortality, our American physicians are now quite dissatisfied with its present indefinite position, and the great desire seems to be to take it out of the catalogue of general diseases produced by common causes, and to rank it as a specific disease, having a

bacterial origin. Croupous pneumonia is one of the most common diseases which affect the lungs. It is the type of all other classified pneumonias. Its symptoms, its course, its issues, are therefore very well known, and if *cold* be excluded from its causation we are more ignorant of its etiology than of any of its fellows. Yet, of it, one of the leading minds of the present day says: "Although several most trustworthy observations enable us to put down cold as its usual cause, this gives us no insight into the way in which the chill operates. For what has partial chilling of the skin to do with the inflammation of an internal organ?"⁴ But inasmuch as the bacteria of pneumonia has not yet been found, what will now be said, as a contribution to its treatment, will be confined to cold, malaria and alcohol, as its exciting and predisposing causes.

And first as to cold. When speaking of it, the phrase "taking cold" must not be confounded with the word *cold* when used as an adjective, as in designating a cold wave, cold weather, etc. In this sense the word *cold* is simply used as an adjective. But the phrase "*taking cold*," conveying the idea that a diseased condition, or a morbid action, is brought by this means into the system, is such an integral part of the nursery catechism that no one will be inclined to doubt the fact. It is an expression used alike by physicians and patients; it is accepted as a truth amongst the earliest impressions of life; it has been felt by every one in their own persons, and is known as a phrase in every language, from the earliest to the latest. It is found in the Hebrew, Greek, Latin, and all written modern languages and, according to some good authorities, in the languages of our Indian tribes. When used in connection with pneumonia

⁴ Rindfleisch. Pathol. Histology, vol. ii, p. 55.

it will be well to be quite precise as to its exact significance, because, if "taking cold" does predispose to, or can directly cause this disease, it is surely well to hold on to the truth in this matter; for it is plain, if "taking cold" does produce it at all, it must accomplish it by some mechanism, or by some order of action. Practically, it is within the scope and bearing of the term "mechanism of pneumonia" to reason upon the process of "taking cold" somewhat in this way:

A patient, having been exposed in a cold place to a continuation of cold air, gets thoroughly chilled; and in this condition, by continuing to inhale the cold air, the already chilled blood in the pulmonary capillaries gets yet more thoroughly chilled by cold applied from without and within, until finally, at various points along the partition walls of the lungs the circulation, becoming slower, is at length checked, and a stasis, or obstruction, results in the network of capillaries, which are spread out so numerous over the air vesicles. These points of obstruction increase with each round of the circulation, until ultimately a large portion of the lung may become involved, and the internal or blood side of the membrane becomes more or less rapidly engorged—giving the first stage of pneumonia.

Notwithstanding the assertions of many to the contrary, yet, it is a fact, that almost every case of pneumonia that comes before the clinician, has a history of some exposure to cold like this, and there are some reasons why a process similar to this may be looked upon as a simple mechanism, or cause, by which the lung membrane can become engorged or blocked at the point in question. A few of the reasons why this may be accepted as a fact are as follows: In theory, at least, it is in accordance with the laws governing the circulation

of the blood in the body; it is tantamount in effect to the law or doctrine once held by the profession concerning a spasm of the capillaries; it is plausible, and not contrary to reason. If the pneumonia does result from cold, it must do so by some mechanism. The parts are there as they have been described; the bronchial terminals, the alveoli, the infundibula, the intertwining arterioles and the numerous capillaries filled with blood; if these parts are quickly changed from a state of activity and health, to that of disease, by cold, how else can it have been done except by stopping the circulation in the capillaries in a manner similar to the one explained? Should this be asserted as a doctrine, it would be a ready explanation for a diseased condition, concerning which there has been, and is yet, a controversy which seems to be interminable, and concerning which the wanted bacterial cause is not to-day considered a solution.

A celebrated pathologist of the present day describes what he calls "the initial steps of the textural alterations in catarrhal pneumonia as follows: "The alveolar epithelia swell," he says, "and produce a thick and continuous layer of protoplasm which is detached from the wall of the alveoli in transverse sections as a nucleated band. The individual cells then separate; the nuclei divide; and active corpuscular proliferation sets in; large spheroidal cells with vesicular nuclei are produced; these cannot be otherwise described than as epithelial elements; they proceed to fill the alveoli, spreading through the stagnant serum which these contain. The intensity of their corpuscular proliferation, the quantity of epithelial elements produced, determine the further course of the inflammation."⁶

⁶Rindfleisch. *Pathol. Histology*, vol. ii., p. 15, where he quotes Colberg who believes that the alveoli are lined with epithelium; others do not.

The mistake made in this description, from the point of view taken here, is, that these textural alterations are *not* initial. The mechanism of pneumonia, in order to be used to advantage as a basis of treatment, should have its starting point at least one step further backwards than the textural changes as they are described by Colberg; with an endeavor to show what caused the congestion. Whether this is cold or not, makes a decided difference in treatment. It may be a matter of regret that anything should prevent this explanation of the mechanism of cold in producing the engorgement of pneumonia, from being accepted, because a good system of practice can be built upon it; but there are two prominent points to be considered, both of which seem, at first, to be directly opposed to this view, but which, singular to relate, both of them, upon reflection, are really in its favor.

The first point is, that the cold air does *not* get down to the lung partition-wall so as to impinge upon and cool the capillaries. It stops at the stationary air space. The external air goes down the bronchial terminals, only to a certain measured calibre in the vessels, and there it stops; from that point to the partition-wall of the lungs the process of respiration is carried on by the diffusion of gases. This is a provision, which may have been made by nature, expressly to prevent this very accident.

The second fact is to be found in the general belief amongst physiologists, and not without good reasons, that it is hard to chill the blood in the internal parts of man, and especially in the lungs, by external cold.

In reference to the first fact, it may be said, the statistics of pneumonia, as they are now accumulated, show that this disease is much more com-

mon in our Southern States, than in the colder climates of our Northern States ; and that this law maintains for colder and warmer climates throughout the world, so that, it is asserted, even in the extreme north the Eskimo are peculiarly exempt from pneumonia.⁷ The physiological working of the stationary air space, between the external cold air and the partition wall of the lungs would not only satisfactorily account for this point as a fact, but would render the assertion of the rarity of pneumonia in a cold climate, highly probable. Where the climate is cold the muscular structure of the bronchial tubes, which presides over the depth of the air space, regulates this matter automatically by a vital force, according to natural and preservative laws. On the contrary to this, where the climate is warm, there is a smaller development of muscular structure in the bronchia, and at the same time, a greater relaxation of the system generally, as well as of the delicate lung textures in particular. The lungs, therefore, expand more readily in the warmer climates and permit the air to pass unhindered lower down into the tubes and nearer to the pulmonary capillaries because the stationary air space is less. In this way the atmospheric vicissitudes that occur very suddenly in our Southern States, have many unguarded opportunities, especially at night, to cool the blood and block its circulation in the lung capillaries. On account of these two facts, if cold is the exciting agent, it might reasonably be expected that there would be a greater prevalence of pneumonia in the southern and warmer climates. But for the reasons already mentioned, the collected statistics, cannot in justice be used, as they have been, for an argument against the theory of

⁷ Loomis, System of Medicine . Pepper, p. 316.

the production of pneumonia by cold, according to the mechanism which has been advanced.

In treating of the second fact, viz: That it is hard to chill the blood in the lungs by external cold. It is to be regretted that no means are yet invented by which the temperature of the blood in the pulmonary capillaries can be registered. So far as the lungs are concerned anatomically, they *are* near the heart, and have a stream of warm blood constantly pumped into them. But there are no lack of illustrations to prove that the general mass of the blood may be reduced in temperature by cold applied externally, even by "chilling of the skin by cold;" cold baths, cold rooms, cold water beds, demonstrate this fact in the treatment of fever. All are familiar with the effect of cold on the function of the brain, and how ice bags produce torpor.

To these illustrations it may be added, that for a long time it was the popular, as well as the clinical belief, held steadfastly until recently, that the agency of "taking cold" in causing pulmonary congestion was a fact established by long observation.

This completes what will be said concerning the mechanism of pneumonia by means of "taking cold." It now remains to show the way in which malaria and alcohol predispose to the same effect. The subject of bacteria will be treated separately, and in a paper by Prof. Wm. C. Welch, of the Johns Hopkins Hospital.

Malaria plays an important part in the statistics of the mortality of pneumonia. There are many kinds of malaria. It is a generic term. Sewer gas malaria in cities which has been asserted to produce pneumonia; house malarias in both city and country; ground malaria; overcrowding ma-

⁸ Loomis—System of Medicine. Pepper, p. 317.

laria, etc., in a great many varieties. But the only malaria that will be chosen for this demonstration is that great general malaria which occupies large districts of territory throughout the temperate and torrid zones, principally at elevations below 350 feet, and is found widespread in our country along sea-marshes and river bottoms; that malaria which produces chronic remittent fevers. The peculiar physiognomy and muddy complexion which this brings about, shows in each case the proportionate amount of textural changes which have been wrought by it. These textural changes are not always exactly the same in every malarial district, but they all affect the spleen, the liver, and the quality of the blood. The spleen is softened and enlarged, the liver is also enlarged, sometimes softened⁹ and again indurated,¹⁰ but always loaded with pigment; having the portal circulation obstructed. Geographically, this kind of malaria and pneumonia, according to the statistics of both diseases, increase progressively, going from the north to the equator. The manner by which this malaria predisposes to pulmonary congestion can be explained in a variety of ways involving more or less mechanical principles. The embarrassed portal circulation and the altered conditions of the blood, together with the marked debility which it produces in the vaso-motor nervous system, by weakening the heart and the muscles of respiration, are the principal factors from which the demonstrations can be made. Time prevents our entering into them more fully.

In what way, or more germane to our caption, by what mechanism, it may be asked, does the long continued habitual use of alcohol in excess predispose to pneumonia? The disease has been

⁹Anderson and Fricke.

¹⁰Rindfleisch. *Pathol. Histology*, vol. ii, p.

called the drunkard's pneumonia, and is a well-marked, well-known and a common disease. In our Southern States alcoholism and malaria often coexist in the same individual, and this is one of the principal causes for the large mortality of pneumonia in those States. The effect which alcohol produces on the liver and lungs has been thus described by Prof. H. Newell Martin of the Johns Hopkins University: "All the blood which flows through the mucous membrane of the stomach goes straight to the liver before it is carried to any other organ in the body. This blood of course takes with it whatever it has absorbed from the stomach. It is therefore not strange that the liver often becomes diseased from a man's taking alcoholic drinks. They cause a great overgrowth of the connective tissue of the liver, giving rise to what is known as *fibrous degeneration*. The true liver substance is crushed and killed and what remains is a shrunken, hard, rough mass, well-known to physicians as 'hob-nailed,' or gin-drinker's liver." The action of alcoholic drinks on the respiratory organs is thus described by the same author: "Indulgence in alcoholic drinks often keeps the mucous membrane lining the air passages in a congested state. It thus increases the tendency to colds of the head and chest. There is also a peculiar form of consumption, which is rapidly fatal and is found only in drunkards."¹¹ This is sufficient upon which to establish a mechanism of pneumonia from alcohol in excess. It will be seen that the circulation is obstructed by the "*hob-nailed*" liver, and although the organs may bear the strain, and naturally adapt themselves to the change for a time, yet ultimately the circulation is thrown quite out of its natural current and equilibrium; and the pulmonary capillaries, al-

¹¹ Human Body. H. Newell Martin, pp. 131 and 184.

ready in a chronic state of congestion from alcohol are easily excited by any other cause, as cold, as still further congestion, and pneumonia ensues.

It will not be necessary, in this presence, to say more concerning the "mechanism of pneumonia" from age, malaria, and alcohol. The structure of the lungs, and their functions; the circulation of the blood through them, and through the liver and spleen, have furnished suggestions to make the demonstration. It is admitted that the merest outline has been given here, but when these altered structures, with their consequences, are pursued, as they can be by the medical thinkers who are now addressed, the conclusions to be drawn from them will be perfectly clear. This mode of showing the production of pneumonia from its various causes, and by means of a mechanism from which it may grow; by which it is governed, and by means of which it may be treated, has been given as a contrast to the *indefinite* picture by which it is too often presented, and which may be largely answerable for its even still more indefinite treatment which has heretofore been offered. In every part of its literature, save one, there is a singular want of precision in the study of this disease. Attracted by the rich field which it offers for thought, less attention has been paid to its initial causes proper, and to the therapeutics flowing from them, than these points demand.

For practical therapeutic use, the presentation of the disease must not begin with a description of its textural alterations, for this is like the commencement of a narrative in the middle of a story, or like the exhibition of half a picture. Its initial cause must be demonstrated and its therapeutics based upon that. While it is difficult not to be influenced by scientific medicine proper, often at too early a period; while there are those who may

be too easily carried away by new theories evolved in the laboratory, it must be acknowledged, that sometimes the most useful man is one who does his best to stop the prevailing mortality of a disease by carefully availing himself of, and keeping loyal to, what is already known; combining with this that which may be reasonably expected in the future; and by avoiding theories far-strained, as well as false dogmas. An equally interesting point for the mechanism of pneumonia to grasp and study, would yet lie before us in the future, if a microörganism should ever be found to produce the disease. But this is not yet the case.

About seven years ago Klebs found what he called an ellipsoid coccus, and thought he had traced it to pneumonia. Since that time this microörganism has been studied by others who have variously called it the nail-shaped coccus, the pneumococcus, or the microörganism of pneumonia. Little is as yet known about it, but enough is *suspected* to make it the duty of a physician to medicate the air of a room in which there is a patient having pneumonia, as will be hereafter explained.

CONCLUSIONS FROM THIS PAPER.

1. The predisposing causes, as the name implies, do not produce pneumonia, *de ipso facto*, but before its commencement they have already worked such structural changes in the human body that upon further disturbance of the system a congestion of the numerous pulmonary capillaries is more likely to occur than any other diseased condition.

2. A study of these structural changes, wrought by predisposing causes, gives advantages both in advisory prophylaxis, as well as in treatment.

The following letter from Dr. Wm. C. Welch is

a summary of what we know of the relation of bacteria to pneumonia :

*My dear Doctor Van Bibber :—*At your request I write you a short account of our knowledge concerning the relation of bacteria to the causation of acute croupous or lobar pneumonia.

Not much importance was attached to the results of bacteriological investigations of croupous pneumonia before Friedländer, in 1883, described and obtained in pure cultivation a bacterium which he found in the affected lung in a number of cases of this disease. This micro-organism was described by Friedländer as a round or oval micrococcus, possessed under certain conditions of a capsule capable of being stained, and presenting the so-called nail-like growth in gelatine. Friedländer's pneumococcus, as the organism is often called, although most bacteriologists now classify it as a bacillus, was found to be pathogenic for mice and in less degree for guinea pigs and dogs but not for rabbits. Inoculations of pure cultures into the lungs of susceptible animals produces pleurisy and *lobular* pneumonia, in rare instances *lobar* pneumonia.

The belief which prevailed for a time after Friedländer's discovery that his pneumo-coccus is, if not the exclusive, at least a common cause of croupous pneumonia has not been confirmed by later researches. It is found that the pneumo-coccus, or more properly the bacillus pneumonia of Friedländer, is not so readily identified by means of its morphological and biological properties as was at first supposed to be possible. Other bacteria have been discovered which can be distinguished from it only by careful and laborious procedures. Little reliance, therefore, can be placed upon much of the work apparently in support of Friedländer's views as it is not certain, or even probable, that the observations in many of the cases related to Friedländer's bacillus. However this may be it is certain that this bacillus cannot be demonstrated in many cases of croupous pneumonia, either in the pneumonic exudation, the sputum, or elsewhere. Even the advocates of the causative significance of Friedländer's pneumonia bacillus now admit that it is the cause of only a small proportion of the cases of croupous pneumonia. In *my* judgment it has not been satisfactorily demonstrated to be in any case the cause of genuine croupous or lobar pneumonia of *human* beings.

At the present time the chief interest in this connection

attaches to another species of bacteria. This species is the micrococcus discovered by Sternberg, in 1880, in his own sputum, and found by him to produce a rapidly fatal form of septicæmia in rabbits—the so-called sputum septicæmia. To this organism Sternberg has given the name of micrococcus Pasteuri. Its relation to croupous pneumonia has been studied with especial fulness and care by A. Fränkel and by Weichselbaum, of whom the former designates the organisms as the micrococcus of pneumonia, and the latter as the diplococcus of pneumonia. In distinction from Friedländer's pneumo-coccus, this organism is sometimes called Fränkel's pneumo-coccus. This second pneumo-coccus—the micrococcus Pasteuri of Sternberg—is present in the exudation and the sputum of croupous pneumonia far more frequently than is Friedländer's bacillus. It is regarded by Fränkel as the sole cause of genuine croupous pneumonia, and by Weichselbaum as the usual cause, the latter author claiming that a small proportion of cases are due to Friedländer's bacillus. The micrococcus Pasteuri has been found as a pure culture in the exudation of cerebral meningitis complicating croupous pneumonia.

It must be admitted that the evidence in favor of the micrococcus Pasteuri being the cause of croupous pneumonia is *stronger* than that in support of Friedländer's bacillus, but it does not seem easy to reconcile with this evidence the fact that the micrococcus Pasteuri has been found in a variety of conditions not associated with croupous pneumonia, viz.: in the normal saliva, in lobular pneumonia, in cerebro-spinal meningitis, in acute endocarditis, and in otitis interna. If this organism be regarded as the cause of these various diseases as well as of croupous pneumonia, the croupous pneumonia loses much of its typical or specific character. Sternberg, Fränkel and Weichselbaum consider that the occasional presence in the normal saliva of the micrococcus Pasteuri is not an obstacle to admitting the dependence of croupous pneumonia upon this organism, but on the other hand renders clearer the etiological rôle played by the accessory causes of pneumonia, such as exposure to cold, bad hygienic surroundings, old age, etc. These accessory causes they urge bring into existence the necessary conditions for the invasion and multiplication of the pathogenic organism.

The two microörganisms which have been mentioned are not the only species of bacteria which have been found in the exudation of croupous pneumonia, but they are the only ones to which bacteriologists are inclined to attach etiological significance in the production of this

form of pneumonia. It is apparent that the evidence is not conclusive that either of the organisms is the infectious agent of croupous pneumonia, certainly no such evidence has as yet been presented as that which leads us to accept the tubercle bacillus, the typhoid bacillus, the cholera spirillum as the cause of the respective diseases in which alone each of these organisms has been found.

Yours very truly,

WILLIAM H. WELCH.

Baltimore, May 2, 1888.

THE TREATMENT OF PNEUMONIA.

This is a difficult subject to approach for many reasons. "Every new remedy almost is tried in turn for pneumonia. It is a disease particularly suitable to speculative medicine.¹²" After reflecting upon the manner in which the subject might be presented, it has been determined to do so in a way different from that which has been ordinarily pursued. It is useless to bring prominently forward oft repeated principles of practice concerning which most physicians have long since made up their minds. The subject will be presented for judgment, and therefore reasons will be given for each point of practice made, no matter how trivial it may seem. The larger and the longer one's observation may have been in the management of this disease, the more he will be likely to appreciate, and to be attracted by, what may be termed, the elegancies of therapeutics. It is fatiguing to the mind to enter into the figures of statistics, and as this has been done so often, and moreover, as there are now no new and corrected collections to offer, let it be taken for granted, that those which have already been published, are sufficient; and that they are as correct as they can now be made; although, what can be proved from them, each

¹² Fothergill. *Hand Book of Treatment*, p. 347.

one's judgment must determine for himself. The only claim which will now be made is that of forty-seven years of observation, and those who may have been co-observers for this length of time, or near it, will recollect that at that time, as it is at present, pneumonia was the disease of the day. It has always attracted attention, and upon its treatment most physicians have based their hopes for usefulness and their expectations for success. The extraordinary appearances of the pneumonic lungs which are presented for pathological demonstration and study, contrast so strongly with the physiological lungs, when displayed, that they never cease to excite wonder and to strike the mind with amazement and dread. No one can forget these appearances, and when a case of pneumonia is under care for treatment, the recollection of them returns, and the physician is burdened with an anxiety which few outside of our profession can estimate.

It has been determined to present the subject of treatment of pneumonia by means of four hypothetical cases. One—a child of eighteen months, or under two years of age. One, a youth twenty-five years old, of uncomplicated pneumonia. One case, sixty years of age, complicated with malaria, and one case, of seventy years old, complicated with old age, malaria, and alcohol. These four cases, it is thought, may sufficiently embrace the subject. These ages have been selected, because, according to the statistics, pneumonia is more common before 2 years of age—less frequent between 2 and 20—common again between 20 and 40—less frequent from 40 to 60—again common after 60. Making three distinct periods, early childhood, from 20 to 40, and after 60.¹³

As the point in view is strictly treatment only,

¹³ Loomis. *System of Medicine*. Pepper p. 314.

in these hypothetical cases, the diagnosis is supposed to have been already made, and the treatment to be commenced immediately thereafter.

Case 1.—An infant between 18 months and 2 years of age. *Directions:* The child to be protected in the best manner possible; to be put in bed, if it will remain there quietly, if not, it should be nursed in the manner in which it will remain most composed, but its position to be frequently changed, so as to prevent the settling of blood in its lungs. The room should be pleasantly shaded and kept quiet, warmed by means of an open fire, and kept at a temperature of from 68° to 70° F. in winter. Its clothing should be slit open in the back at the first visit, so as to get free access to the bare skin without trouble. Its diet should be diminished to one-third of its usual quantity of food. Modify its bath, its amusements and the use of its voice, and in all attention to it, have only the one nurse with whom it will be most quiet in the room. To cry, as well as to talk, is bad for pneumonia.

The question should be now determined what remedies will be used in this case of disease.

1. Commence with a gentle purgative—the transference of a slight irritation to the intestines is a good treatment. *Ol. ricini* is the best, and more easily given when skimmed off of warm, sweetened water, flavored with mint.

2. Antifebrin gr. $\frac{1}{2}$, in solution, in sweetened water; this is intended to gradually diminish the heat of the blood. To assist nature thus far, even with the advanced theories before us concerning the pneumonic fever, is a good practice; if the pneumonic fever runs *too* high, this will control it.

3. The muriate of ammonia $\frac{1}{2}$ gr. every four hours, to be given alternately with the antifebrin.

This salt is better given in solution in weakened and sweetened spear-mint water.

4. Muriate of ammonia gr. 4 to an ounce of whisky, or bay rum. This is to be applied hot on a well fitted linen pad—3 x 4 inches—on the skin over the roots of the lungs, and to be covered by a a flannel pad and a well fitted oil silk arrangement; also, the feet may be rubbed with the same solution, the object being to carry off the supernatant heat and thus produce sleep and quiet.

5. To medicate antiseptically the air of the room. Bromine, chlorine, iodoform, carbolic acid, or other substances, in solution, to be placed in the apartment, near the child; where such a medication of the atmosphere will be made most potent for its good. The breathing of a properly medicated atmosphere is the most powerful mechanical mode of treatment. It is as constant, and as long-continued, as life itself. The bromo chloralum, 1 part to 20, answers a good purpose.

6. Repeat the gentle purgative every second or third day.

7. Continue this treatment without intermission for seven to ten days.

Pure pneumonia, in an infant at this age, is frequent, and is sometimes the slightest, and again the most serious of diseases. The statistics, for all classes may be consulted, in order to prognosticate how many cases similar to the one here described may recover. Practically, we may say, that if these seven directions are fully carried out, in good faith, that at least eighty out of a hundred of those cases which occur in private practice, amongst persons in good circumstances, will be cured. This proportion presupposes that the treatment is commenced as soon as the crepitan râle can be detected. This is encouraging.

Case 2.—A youth, 25 years old—uncomplicated

pneumonia. *Directions:* 1. To be put to bed at once and follow the same general directions for temperature, shading, and quiet of the room as in the first case.

2. The diet to be reduced one-third of the habitual amount of nourishment ordinarily used, and a proper selection of articles chosen to suit the occasion, but the amount of food should be proportioned to the area of lung involved, if possible.

3. The initial purgative should be a saline. An effervescing saline aperient is the best.

4. Medicate the atmosphere of the room at once.

5. Antifebrin gr. iij to v, or antipyrin gr. 4 to 40 in cool water, and mur. ammonia gr. iij, in hot water, each given every four hours, alternately—one or the other every two hours.

6. Six scarified cups, drawing six ounces of blood, and six dry cups to be applied over the roots of the lungs, with a medicated poultice afterward applied to the cupped surface; when the irritation from the cupped surface has subsided apply the pads wet with the muriate of ammonia and whisky or bay rum to the back. Renew the cupping every three days or oftener, if necessary, with half the quantity of blood drawn. Give the purgative every two or three days, to be given early in the morning preferably. Protect the chest and arms with warm clothing, a flannel Nightingale is the best.

7. Continue this treatment without abatement for sixteen days, so that all trace of inflammation in the lungs may be subdued.

8. Medicate the air of the room thoroughly.

This latter is a case which would give more apprehension than the first one, because, as a rule, the older the patient, the more serious the pneumonia. This case, like that of the infant, is supposed to

be a type case of uncomplicated pneumonia. Like the first one, also, it is supposed to have been recognized at the beginning of the crepitant râle, and immediately thereafter submitted to treatment; with these premises granted, the prognosis is favorable in both cases, and the recovery, by the treatment instituted, should be complete. But it must be emphatically said, for these two cases, that, had they not been thus early recognized and properly treated, the result would have been different; because, from the mechanism of the parts which make up the disease, and the function of the organs involved, it is evident that pneumonia is a progressive disease. It cannot safely be trusted to the efforts of nature amidst the ordinary accidents of life without a proper and a vigorous treatment. From its essential nature it must spread in the lungs if not cared for, and unless stayed, will mechanically get such a lodgement there, as to destroy life as an acute disease, or cause the patient to be an invalid from chronic structural changes.

Case 3. Pneumonia occurring in a patient about 60 years old, complicated with remittent malaria. This case is yet more serious than the other two: the increased age, and the deteriorating malaria, giving their disadvantages to the patient.

Directions. 1. The same general directions as in the first two cases as to rest, temperature and shading of room, exposure of back, extra warmth for arms and chest; but the flannel should be heavier than in the other case. Be still more vigilant about changing positions in bed, and have the cuppings always done whilst in the recumbent posture, and this can be readily accomplished.

2. The effervescing saline aperient. The after opening treatment, in one of this age, may be

done by some of the saline mineral waters; they refresh the stomach, and acting as resolvents, actually increase the vigor of the system.

The malarial complication must be met by the administration of quinine. Hypodermic injection is preferred. Six grs. of the alkaloid, or a solution of the hydrobromate, should be injected three times a day for three days; the hypodermic solution of the hydrobromate of quinine is the best. On account of the advanced age a somewhat greater support should be given to the patient; and smaller cuppings must be ordered.

3. *Remedies.* If the temperature is high, give antifebrin somewhat according to the rules and observations of Dr. G. Walter Bart,¹⁴ 5 to 15 grs. every four hours, alternately with muriate of ammonia grs. iij in hot water, also when the cupped surface will permit, apply the muriate of ammonia solution 20 grs. to the ounce of whisky or bay rum, covered with the flannel and oil-silk pads, as before directed.

4. Medicate the air antiseptically. Upon this the greatest stress is to be placed.

5. Give the saline aperient water every second or third day.

6. Continue this treatment without intermission for from sixteen to twenty days.

This case is more serious than the others, and the statistics of mortality, for all classes, would give a large percentage of mortality for the class of which this is intended to stand as a type. The treatment, however, has been carefully selected, and if fully carried out in good faith, in private practice, amongst persons in good circumstances, it will be found that a large number recover.

Case 4. Patient 70 years old, complicated with old age, malaria and alcoholism. The number of

¹⁴ See Practitioner, October, p. 294.

years being given, and the term old age applied, presupposes that this latter is premature on account of the malaria and alcohol.

Directions. 1. The same general plan of treatment would be advised for this patient as it regards the appointments of the room, the clothing, the cupping, postural changes, etc.

2. The same remedies to be used, *i. e.*, the antifebrin, in capsules, the carb. ammonia—in place of the muriate—or alternating with it. Larger diluents of light mineral waters—the muriate of ammonia pads, the antiseptis of the air, the hypodermic use of quinine. The modifications to be made in this case are for the alcohol habit, and the age; these are important on account of the supposed long continued habitual use of alcohol—it cannot be suspended abruptly—but whatever preparation is selected to carry on the habit, it must be largely diluted with water; wine-whey, or weak whisky and water are the best.

In order to show the practical application of the plan of treatment which has been suggested, it will be necessary to recapitulate the articles and explain, somewhat in detail, the *modus operandi* of the several remedial means employed. The rest, warmth, postural changes and external applications, require no further mention. Much stress is laid on cupping over the roots of the lungs, between the shoulders, or more particularly still, between the third and eighth dorsal vertebræ, and for this reason. It will be remembered that the lungs are pedunculated organs. Together with the heart they can be taken from the body entirely by the severance of their roots. They are internal, but in another sense they are far removed organs; the length of the pedicle giving them their peculiarity. In this respect they have their analogues in the testes, the ovaries, the small intestines and

other pedunculated organs. If the circulation in the pedicle be obstructed, the pedunculated organs suffer in consequence. *Whatever enters into the lungs, or is returned from them, must pass through the roots.* It must therefore be of the first importance to keep their circulation through the roots open and free. Cupping over the roots is the best known means to effect this purpose according to the laws of counter-irritation over affected parts. The argument that there is no vascular or other connection between the roots of the lungs and the skin must be laid aside by the experience in the matter. Besides this, the actual abstraction of the blood, and the holding of a certain amount of it in one place *pro tempore*, is a means of derivation relieving local tensions, and when employed for this purpose, and with this aim in view, the cupping should be done, if this is possible, at the moment when the tension is greatest. It is thus a means of controlling, or at least of moderating the effects of high arterial action during fever. *Again, cupping is most valuable from the relief of pain, and feeling of oppression, which it affords.* There is no one remedy more valuable, in the treatment of pneumonia, than frequent small cuppings, applied with judgment, at the proper times, according to given principles. By arranging the clothing as described, it can be done without inconvenience, and without removing the patient from the horizontal position.

If we exclude the initial opening dose, the medicines recommended are only five in number.

The first, the muriate and the carbonate of ammonia, have been selected because they answer more of the indications required than any medicines which have ever been proposed. Of the muriate, it is said that by its own peculiar properties it acts upon the circulation in the capillaries

and assists to unload them when they are engorged. When given in hot water it is a resolvent, a general expectorant, and a diaphoretic. It seems, upon practice, to act in the way described, and, if persisted in, to meet more of the indications, and to do more good, than any other medicine which has been tried. When flavored with spearmint water it is acceptable to children, and when given in hot water does not produce nausea in older persons. The carbonate of ammonia is more stimulant than the muriate, and it is also a resolvent, and is a remedy which seems to prevent embolism or the coagulating or engorging of the blood in the capillaries. Again, used in another way, for inhaling, carbonate of ammonium is so volatile that it will carry with it other remedies and not destroy their effects. Placed in a large, wide-mouthed, well stoppered bottle, it may be charged with carbolic acid, chloroform, thymol, or any of the antiseptics without injuring their effects, and in this way, inhalants, besides the medication of the air in the apartment, may be used in pneumonia with good effect. This inhaling bottle should be large, and used efficiently by means of deep inhalations.

Antipyrin and antifebrin are comparatively new remedies, yet, so far as their effects have been observed, they seem to control fever by diminishing the heat of the blood. Their effects have been thus compared and placed in juxtaposition:

Antipyrin lowers temperature in half an hour. Effect lasts two hours. More diaphoretic. Depressing after-effects. Cerebral sedative. Dose 15 to 30 grains. Tolerance from continued use.

Antifebrin lowers temperature in an hour, or more. Effect lasts six hours. More diuretic. No after-effects. Cerebral vaso-motor muscular stimulant. Dose 5 to 15 grains. Tolerance from continued use.

These are valuable remedies in pneumonia. But antifebrin is the best.

Of digitalis, veratrum viride, strychnia, strophanthus, and many other remedies proposed, much can be, and has been, discussed, concerning their action connected with fever and its deservence, and heart failure; and they may be valuable remedies in the hands of those accustomed to their use—but their therapeutics are not sufficiently settled to warrant their exhibition in any *system* of treatment or cure.

It is interesting and instructive to study pneumonia in its mechanical aspect, if it is only to grasp the problems of the phrase "heart failure," which is so much used by those who have written of its treatment. Heart failure is *the most frequent, as well as the most immediate, cause* of death. Its mechanism is complicated. Reduced to a few principles it may be said: *First*, In pneumonia there is diminished lung area, and consequently a diminished supply of arterial blood. *Secondly*, the pressure of the exudation and engorgement in the swollen substance of the lung is the obstacle. *Thirdly*, the amount of blood which arrives in the heart has to be forced through these obstructions. This brings a heavy weight upon the right ventricle. *If this is continued* the heart must fail. What course should treatment pursue? Will it force the heart by digitalis; weaken it by veratrum; strengthen it by strophanthus; drive it harder by alcohol? Or, would it be better to endeavor to ease the heart, and to divert its force by cupping? The force is in the current, as the stream of blood arrives, and the strain is on the right side, on the ventricle, to drive the blood through the obstructions.

Repeated and repeated cuppings, in quick succession, it may be, are the safest and the best di-

verting means which a study of this fearful condition can suggest. To open a vein just at the supreme moment might be better, but there are few physicians who would not consider the cuppings a more safe teaching—and possibly, unless very sure of the moment, a better practice.

The four cases introduced to explain the plan of treatment recommended were hypothetical, and it remains finally to make a summary of them. When the two first cases were reported recovered it was not surprising. Their cases were diagnosed early and treatment commenced immediately; it was thought fair and proper that they should recover. The third case, however, might be considered a test of good management from the beginning. This case, according to statistics, had less than an equal chance. If a mistake had been made by an indefinite treatment, it would have jeopardized the life of the patient at once. But the fourth case, 70 years old, with malaria and alcoholism, would not recover according to statistics. During a course of an indefinite *individual treatment* something might have been done which would prove injurious to the patient; but by the plan here proposed, *founded* upon the *mechanism* of the disease, it can be safely assumed that nothing injurious would be done; but, with the frequent cuppings to prevent heart failure, the supporting diet and personal hygiene; besides the continued medication of the air, and the inhaling of antiseptics; with the two resolvent ammonias and the antifebrin; with the antiseptic resolvents applied hot externally, together with a good moral support, we may leave this desperate case as doubtful, yet not without hope.

No mention has been made in the course of treatment of the pneumonia "*foudroyant*," which kills the patient almost like a thunderbolt, be-

cause these cases are scarcely recognized before the overwhelming catastrophe occurs. What should be promptly done in these cases is general venesection if one is sure of his case, but at any rate extensive cupping, to prevent the overwhelming congestion. At the same time medicate the air of the room, and use stimulating inhalants, with a view of reviving the patient, to divert the blood by again and again frequent cupping, so as to preserve the heart; and if these, happily, may stay the progress of the disease long enough, then, to commence the plan of treatment recommended.

CONCLUSIONS.

1. The mechanical interference to the circulation and aeration of the blood in the lungs is the main symptom to be combated in the treatment of pneumonia.

2. It requires prompt, urgent and aggressive treatment in the earlier stages of the disease, and this mechanical relief can only be afforded by decided local depletion.

3. Even after the effusion into the parenchyma has occurred, it requires still further local depletion to preserve the heart, and keep open the circulation in the roots of the lungs.

4. Pneumonia admits of study by mechanical as well as vital principles, and its pathology may be elucidated and its treatment improved by study in these directions.

